DEFINING OLD GROWTH IN THE SOUTHEAST: EXAMPLE OF CYPRESS

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INTRODUCTION

There is a lot of misunderstanding over what comprises an old growth stand, because there is no well accepted definition of old growth. Malcolm Hunter (1989) proposed a broad conceptual definition: "old-growth forests are relatively old and relatively undisturbed by humans." Because there can be large differences among forest types, he suggested that specific definitions for each forest type could be derived from the broad definition and that age and disturbance criteria that may be ecologically significant could be modified to form locally appropriate definitions. This is the approach that the USDA Forest Service has taken. In this paper we review the process of defining old growth in the southeast, the format for the definitions of old growth forest type groups and the progress that has been made, and we discuss an example of one forest type group: the cypress-tupelo type.

DEFINITION DEVELOPMENT

A national Old Growth Task Force was formed by the Forest Service in 1988 in order to address old growth issues, including the problem of lack of definitions for old growth forest types. Old growth was officially recognized as a resource by the Forest Service, at the recommendation of the committee. Shortly after, all Forest Service regions began developing definitions for certain forest type groups (Nowacki, 1991). In May 1991 a meeting was held at Muddy, IL, at which representatives of the Forest Service regions and stations in the Southeast agreed on a strategy for formulating old growth definitions. The southern and eastern regions of the Forest Service combined their efforts to develop definitions, because they share many forest types. In addition a cooperative agreement was drawn up with The Nature Conservancy to provide coordination and technical support. It was agreed that initial old growth definitions would be developed for 42 broad forest types.

There is a lack of quantitative data on old growth forests for many of the types, so a number of the definitions will be mostly descriptive. It seems better to proceed with an interim definition which could be modified as times goes on, than to wait until funds can be acquired and quantitative data can be obtained for representative old growth stands. In fact, the definitions can help in recognizing information gaps.

Factors that influence the structure and function of old growth were chosen as part of the definition, including: site factors that affect the number of trees, biomass and spacing, disturbance regimes, physiognomy, dominant tree species and geography. Definitions are planned for all natural ecosystems, including: forests, woodlands, and savannas, as well as short-lived forests, in the Southeast. These definitions are not a comprehensive effort, but are just a beginning. The forest type groups defined are broad. The definitions are linked to the region's Ecological Classification System and to SAF types. Each definition includes a generic introduction, and a description of the forest type group that consists of location, landscape occurrences, dominant and associated species, disturbance regime and distinguishing features. Following that is a table of old growth attributes in English (Table 1) and metric which includes a range of values, a mean, number of stands from which data were available, and a list of

references. The table includes data on trees in the main canopy, dead trees, and canopy structure. A narrative of old growth conditions provides information on the living tree component, including the structure and composition, age characteristics, and canopy characteristics; the dead tree component, including standing snags and down woody debris on the forest floor; and other features such as understory characteristics, including sapling and seedling composition, shrub and herbaceous plant composition, soils and microtopography, and associated flora and fauna. The section on forest dynamics and ecosystem function contains details on ecological processes during the old growth stage, presettlement disturbance regime, with implications for determining the size of the area needed for forest maintenance, current conditions that affect how present-day forest type groups differ from presettlement time. Also included are a list of representative old growth stands and sources of information.

CURRENT STATUS

Forest Service scientists are working on most of the definitions; some of the definitions are almost finished, and a few are just started. The Nature Conservancy is responsible for one definition, and scientists outside of the Forest Service, with expertise on four of the minor communities, are writing definitions for those forest types.

CYPRESS: AN EXAMPLE

HISTORY

The following is information on one forest type, the cypress-tupelo community. The Mississippi River Floodplain stretches south along the border between Louisiana and Mississippi in a broad zone about 50 miles wide and 400 miles long. Vast stands of virgin cypress once grew in the swamps and bottomlands of the floodplain, as well as along other rivers and lakes of the area (Viosca, 1928). At the time of European colonization, an estimated 11 million to 12 million acres (4.4 to 4.8 million ha) of forested wetlands existed in Louisiana, but by the mid-1970s only about half the original acreage was left (Turner and Craig, 1980). The amount of forested wetlands has continued to dwindle.

The French and Spanish began cutting cypress trees for their own use as soon as they arrived in the Gulf Coastal area, and by 1723, a small amount of cypress lumber was being exported. However, logging in swamps was extraordinarily difficult. If a solid bank existed along the river or lake, mules or oxen were used to tow logs out, but this was usually not the case. The French soon learned that green cypress logs frequently sank in the water, while dry cypress normally floated. Trees were girdled and left in place until they were light enough to be floated out of the swamps to the mill. Throughout the colonial period cypress lumbering slowly expanded, only the finest trees in the easiest to reach locations were logged (Mancil, 1972).

Around 1890 pullboats and overhead railroad skidders began to be used as a way to get cypress logs out of the swamps, and the industrial period of cypress logging began. A dramatic increase in the use of cypress occurred as a result of the dwindling northern lumber industry, availability of cheap land, and development of new logging and milling techniques (Mancil, 1972). In 1913, 744 million board feet of cypress were harvested in Louisiana, and in 1915, 150 cypress mills were operating in the state (Mattoon, 1915). However, the industrial cypress era was short-lived, and by 1925 only a few stands of commercial importance were left. By the 1930s virgin cypress was extremely uncommon. A memorandum written in 1939 by L. Cook, Chief of Forestry of the National Park Service, states: "In Louisiana, cypress logs that have been lying

TABLE 1. This table's attributes will be part of each old growth definition.

Table of Old Growth Attributes (English)

Quantifiable Attribute	Range	Mean	No. of Stands[1]	References
Live Trees in Main Canopy				
Stand Density (# acre^{-1})				
Trees ≥ 4 in dbh				
Trees ≥ 20 in dbh				
Stand Basal Area (ft^2 acre^{-1})				
Trees ≥ 4 in dbh				
Trees ≥ 20 in dbh				
Average Age of Large Trees (yr)[2]				
Cypress				
Tupelo				
Variation in Tree Diameter				
Number of 4 in Size Classes[3]				
dbh of Largest Trees (in)				
Dead Trees - Coarse Woody Debris				
Standing Snags (# acre^{-1})				
Down Logs (ft^3 acre^{-1})				
Tree Decadence				
Decadent Trees (# ha^{-1})[4]				
Tree Canopy Structure				
No. of Canopy Layers				
Percent Canopy in Gaps				
Other Important Features				
Height				

[1]Number of stands may not equal number of citations
[2]Dominant and codominant overstory trees
[3]Minimum number of trees needed within a size class before inclusion
[4]Deformed, spike topped, or trees with bole decay

on the ground for many years are now being salvaged due to the growing scarcity of standing timber of large size."

In 1939 a proposal was made to the National Park Service that a cypress monument be established to preserve an example of old growth cypress before all of it was cut. Three areas were proposed for consideration, including the old growth cypress swamp at Stinking Bayou near Pass Manchac, Louisiana. King and Cahalane (1939) describe the forest as follows: "The climax of the trip was reached on Stinking Bayou, where a magnificent stand of cypress has escaped destruction by man. The trees are tall, beautiful specimens, many of them with trunks three to four feet in diameter and 40 to 50 feet up to the first limb. The stand appears sparse, but is considered typical of the habitat." The proposal to establish a cypress monument was not acted upon, and the cypress forest was cut. Today the Stinking Bayou area is a marsh, where an occasional cypress stump can still be seen, because cypress has not regenerated there.

In 1936 the Louisiana Cypress Lumber Company cut one of the last virgin stands of cypress, covering approximately 13,500 acres, near Pontchatoula, Louisiana, in the same area as Stinking Bayou. Data were recorded in 30 10x10 meter quadrats in the swamp. Only four tree species appeared in the quadrats: cypress (Taxodium distichum), swamp tupelo (Nyssa biflora), red maple (Acer drummondii), and sweet bay (Magnolia virginiana). Cypress dominated the swamp, occurring in every quadrat and accounting for more than 76 percent of the total basal area. There were 2.5 mature cypress trees per quadrat, with an average dbh of 21.2 inches. The largest cypress had a dbh of 54 inches. In contrast, swamp tupelo, red maple, and sweet bay contributed only 22.2 percent, 1.1 percent, and 0.1 percent of the basal area. The two principal trees, cypress and tupelo, also differed in the number of seedlings produced. Cypress seedlings occurred in every quadrat, while no tupelo seedlings were found. Sixteen vines and shrubs and 19 herbs occurred in the quadrats.

PALEOCLIMATOLOGY FROM CYPRESS

Although practically all old growth cypress forests have been cut, scattered trees 1000 years old and older exist. Locating solid trees of this type is not easy; 100 year old cypress trees (approximately 15 inches in dbh) are abundant and solid trees 200-400 years old are numerous, but beyond this age, many of the trees are hollow. Cores from these trees are being used by the USDA Forest Service's Southern Global Change Program[1] for paleoclimatology, because annual variation in ring-widths provide some of the best proxy records for reconstruction of past climate.

After ancient cypresses have been located with color infrared photos and Calibrated Airborne Multispectral Data (CAMS), researchers proceed to the site and use an increment borer to extract core samples. The samples are air dried, placed in wood mounts, and sanded in order to make clear the annual ring boundaries and earlywood and latewood cells. Usually wide rings are formed in years of adequately spaced, abundant rainfall, and narrow rings occur in drought years. Each core is placed on a stage equipped with a linear encoder and the annual rings are measured to within 0.001mm under a stereomicroscope with a video monitor. Crossdating (accurate dating of ring widths) is accomplished by graphically and statistically comparing ring widths to a composite of previously measured trees (Van Deusen *et al.*, 1993).

In addition to living trees, well preserved, ancient cypress logs remain in the swamps. It is possible to match ring width patterns from ancient buried and sunken trees with cores from living trees. Recovery and dating of sunken trees could enable researchers to extend the tree ring record to 5,000 years or more. Carbon dating of a cypress stump found at Port Hudson when the

[1]For information on the Southern Global Change Program, contact Susan Fox, Program Manager, Southern Global Change Program, USDA Forest Service, 1509 Varsity Drive, Raleigh, NC 27606.

Mississippi River was low yielded an age of over 41,000 years. The longest continuous chronology in the world, based on overlapping records of living and relic wood from bristlecone pine, dates to 6700 BC. It has become apparent only in the last decade that cypress could challenge bristlecone pine as the longest climate-sensitive chronology. Perhaps more important is the realization that climate signals such as hurricane strikes are recorded by coastal cypress trees. Data from cypress cores could prove valuable for testing conjecture by climate modelers that the greenhouse effect will increase hurricane frequency.

This is just one example of why old growth forests are important. In addition to the significant values associated with old growth forests which we already perceive, such as biological diversity, aesthetic values, wildlife and fisheries habitat, recreation, and water quality, the ancient forests may have uses that we are not aware of at the present. Definition of old growth forest communities is an important part of the process...of managing old growth forests for their many pivotal values.

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